

# **CREST Status Report**

## **15 June - 15 October, 1997**

### **Overview**

Principal efforts of the Consolidated Reporting of EarthquakeS and Tsunamis (CREST) project during this period were devoted to further instrument testing, software development, analysis of communication needs, and siting. In addition, we began procurement of equipment and installed computers and software at several sites. In this status report we review progress in each of these areas. Site installations still await receipt of field equipment.

### **Instrument Testing and Procurement**

We found it necessary to continue evaluation of digital data loggers. In our previous report we discussed the noise tests that we conducted. During this period we found that selection of the vendor dictated the choices for communicating with the equipment. Some vendors provide hardware and software to receive the digital data, other vendors supply only software, and some vendors supply neither software nor hardware. In the latter case, the data loggers might be less expensive, but we would expend salary funds to develop this necessary software and hardware package. Likewise, some dataloggers provide data packetization and the ability to re-send corrupted packets, while others do not. Because the success of the CREST effort depends on rapid delivery of data during critical events, data integrity vs. delay time has become a performance requirement of the datalogger. We developed final specifications for the "low-power" data loggers (for sites without A/C power) in September and issued paperwork for procurement. We expect to make the selection in October. We have selected and ordered dataloggers for the three USNSN-style stations, as this equipment is not subject to low-power requirements and needs to be compatible with hardware installed at other USNSN stations.

Based on our previous testing of sensors, we issued requisitions for accelerometers and broadband sensors for both the USNSN-style stations and the regional-network-style (RSN) stations. We also conducted further testing of accelerometers to determine whether we could recover a large (~1 meter) DC component of displacement, which we expect could occur as a result of major subduction zone earthquake. Preliminary test results are disappointing and indicate that the sensors may exhibit non-linear effects or hysteresis when subjected to continued high levels of shaking. Pending the outcome of these tests, we may recommend that continuous GPS instruments be considered for CREST sites if such information is considered desirable by the warning centers.

### **Software**

We installed Version 1.0 of the Core Tsunami System (CTS) at the NCSN (Menlo Park), PNSN

(Seattle), AEIC (Fairbanks), and ATWC. The CTS software acquires the digital data, locates earthquakes, exchanges information among CREST participants, and will ultimately compute ancillary information about large quakes (moment tensors, shaking maps, etc.). We are now sending continuous digital data from 12 NCSN sites and 1 site in the PNSN to ATWC via the Internet, and ATWC has developed software that can incorporate this waveform data into their software system. ATWC is also receiving hypocenter information in real-time from the NCSN. Software development is focussing on development of tools to retrieve waveforms for post-processing (e.g., moment tensors) and to acquire digital data from the dataloggers. More documentation about the CTS software can be found at "<http://www.cnss.org/EWAB/status.9709.html>".

A CTS computer (Solaris Ultra 170) was installed at the UW and is currently acquiring and processing earthquake data from the PNSN in parallel to their existing system. A new VAX/VMS computer was installed at HVO to support their CUSP software system. In addition, 12 analog stations from the HVO network are now being sent directly PTWC. HVO is also procuring the hardware to operate the CTS A/D subsystem as a potential replacement for their CUSP data-acquisition hardware.

We are continuing our efforts to make the real-time earthquake display software currently running on the WWW available to other RSN's. We anticipate that it will soon be possible for any CREST participant to provide data to the public and OES clients in a robust fashion. This mode of data distribution will compliment active "push" technologies like CUBE/REDI/RACE which utilize wireless technologies as well as dedicated lines of communication as outlined above.

## **Communications**

An investigation of communication options was conducted by the USGS Information Systems Division for CREST. From throughput and reliability requirements we provided, they have recommended three options for connecting the RSN's to the TWC's and each other. The options provide increased levels of committed data bandwidth with corresponding increasing cost levels.

Option 1 provides the most reliable network solution. It is comprised of new, dedicated point-to-point circuits. Bandwidth is guaranteed, as we would not share the circuits with any other users. Installation costs are ~ \$30K, with recurring costs of ~\$15K/yr.

Option 2 is a hybrid network with a private Frame Relay cloud on the DOINET infrastructure. It utilizes existing DOINET and ARTNet carrier circuits where available and requires new circuits elsewhere. Installation costs are ~ \$35K, with recurring costs of ~\$5K/yr.

Option 3 is a hybrid network which utilizes the DOINET infrastructure with priority queueing. It

does not provide a private Frame Relay network, but instead takes advantage of triggered priority queueing to guarantee bandwidth during an event only. Installation costs are ~ \$15K, with recurring costs of ~\$5K/yr.

All options will have a redundant 56kbps dial-up service utilizing ISDN, where available to enable communications over an alternate link. We anticipate establishing a redundant link via satellite services, but have not investigated the options yet. We are evaluating the advantages of each option and expect to make a decision in November.

## **Site Selection**

Sites have been selected for either upgrade or new installation in Year 1. We are currently visiting these field visits to collect seismic noise samples using broadband instruments. To date we have collected data from sites in Alaska and California. Technical difficulties were encountered with the survey in Washington. A site visit to Hawaii is scheduled for October. Site installation will occur as instrumentation is delivered and as weather is permitted.